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EXAMINER
FITZPATRICK, ATIBA O

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2624	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

	Application No.	Applicant(s)
Office Action Summary	10/563,957	FUNAYAMA ET AL.
	Examiner	Art Unit	
	ATIBA O. FITZPATRICK	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
  Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on <u>04 November 2008</u>.

2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.

3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4) ☒ Claim(s) <u>1-40</u> is/are pending in the application.

    4a) Of the above claim(s) <u>11-22 and 30-40</u> is/are withdrawn from consideration.

5) ☐ Claim(s) _____ is/are allowed.

6) ☒ Claim(s) <u>1-10 and 23-29</u> is/are rejected.

7) ☐ Claim(s) _____ is/are objected to.

8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9) ☒ The specification is objected to by the Examiner.

10) ☒ The drawing(s) filed on <u>12 July 2006</u> is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.

    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a) ☒ All b) ☐ Some * c) ☐ None of:

      1. ☒ Certified copies of the priority documents have been received.

      2. ☐ Certified copies of the priority documents have been received in Application No. _____.

      3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

    * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08)
    Paper No(s)/Mail Date <u>08/21/2007, 07/20/2006, 03/31/2006</u>.

4) ☐ Interview Summary (PTO-413)
    Paper No(s)/Mail Date. _____.

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

Applicant's election of claims 1-10 of Group I in the reply filed on 11/04/2008 is
acknowledged. Because applicant did not distinctly and specifically point out the
supposed errors in the restriction requirement, the election has been treated as an
election without traverse (MPEP 818.03(a)). Applicant has amended claims 23-29 to
depend from independent claim 1 of Group I. Therefore, claims 1-10 and 23-29 are
examined as set fourth below.

Specification

The title of the invention is not descriptive. A new title is required that is clearly
indicative of the invention to which the claims are directed.

Claim Objections

Claims 1 and 5 are objected to because of the following informalities: Claim 5
includes the limitation "processing target frame", which does not make sense. Does this
mean that the target frame performs processing? Claim 5 includes the limitation "is
angles made by", but this is grammatically incorrect. Appropriate correction is required.

Claim Rejections - 35 USC § 102

(b) the invention was patented or described in a printed publication in this or a foreign country or in public
use or on sale in this country, more than one year prior to the date of application for patent in the United
States.

Claims 1-9 and 23-29 are rejected under 35 U.S.C. 102(b) as being anticipated

by J. Heinzmann and A. Zelinsky, "3-D facial pose and gaze point estimation using a

robust real-time tracking paradigm," IEEE Int. Workshop on Automatic Face and

Gesture Recognition, pp142-147, 1998) (Heinzmann).

As per claim 1, Heinzmann teaches an image processing apparatus for estimating a

motion of a predetermined feature point of a 3D object from a motion picture of the 3D

object taken by a monocular camera, comprising **(Limitations present only within the**

preamble are not given patentable weight):

observation vector extracting means for extracting projected coordinates

of the predetermined feature point onto an image plane, from each of frames of the

motion picture **(Heinzmann: page 142, col 2, para 2: "forwarded to the 2-D model…**

image plane… 2-D image positions of the features"; Fig. 1);

3D model initializing means for making the observation vector extracting

means extract from an initial frame of the motion picture, initial projected coordinates in

a model coordinate arithmetic expression for calculation of model coordinates of the

predetermined feature point on the basis of a first parameter, a second parameter, and

the initial projected coordinates **(Heinzmann: Fig. 1; abstract: "3-D model… initialize**

the feature tracking": paramaters: abstract: "feature positions… gaze direction…

head rotation": Fig. 1: "feature positions… relative positions". Fig. 1 shows that

the projected coordinates are extracted from the 2-D model into the 3-D model.

page 142, col 2, para 2: "2-D image positions of the features are transferred to a 3-

D model of the feature locations"; page 144, col 1, para 5 – col 2, para 1 : "affine

transformation… a good approximation of perspective projection provided the

depth of the object does not exceed 1/10 of the distance between camera and

object. This is usually the case in face tracking applications.": Therefore, a

parameter is the depth of object which is not expected to exceed 1/10 of the

distance between the camera and the object; page 144, col 2, paras 2-3: "angle";

page 144, col 2, paras 4-5: "theta… orientations"; Fig. 3: "camera coordinates..

angles"; Fig. 2: "angles"; page 145, col 1, para 3 – col 2, para 1: "distance and

orientation"; page 145, col 2, para 2: "depth". Fig. 4: shows 9 parameters. page

146, col 1, para 3 – col 2, para 1: "Figure 4 shows the output of some tracking

parameter including the rotational angles, the displacement, the gaze direction of

both eyes and the uncertainty of the face tracking"); and

motion estimating means for calculating estimates of state variables

including a third parameter in a motion arithmetic expression for calculation of

coordinates of the predetermined feature point at a time of photography when a

processing target frame of the motion picture different from the initial frame was taken,

from the model coordinates, the first parameter, and the second parameter, and for

outputting an output value about the motion of the predetermined feature point on the

basis of the second parameter included in the estimates of the state variables

(Heinzmann: page 142, col 2, para 2: "The estimated positions of the features

determine the location within the next image frame of the hardware search

windows." Note that the state variables include the parameters that were listed

above: page 142, col 2, para 2: "3-D triplets"; Fig. 1: "3-D pose": output),

wherein the model coordinate arithmetic expression is based on back

projection of the monocular camera, the first parameter is a parameter independent of a

local motion of a portion including the predetermined feature point, and the second

parameter is a parameter dependent on the local motion of the portion including the

predetermined feature point **(Heinzmann: page 142, col 2, para 2: "The 3-D model is**

also projected back into the image plane to adapt the constraints in the 2-D

model."; abstract: "monocular"; page 144, col 1, para 5 – col 2, para 1 : "affine

transformation… a good approximation of perspective projection provided the

depth of the object does not exceed 1/10 of the distance between camera and

object. This is usually the case in face tracking applications.": Therefore, a

parameter is the depth of object which is not expected to exceed 1/10 of the

distance between the camera and the object. This parameter is independent of

local motion. Note that parameters are also listed above. page 145, col 2, para 2:

"monocular"), and

wherein the motion estimating means:

calculates predicted values of the state variables at the time of photography when the

processing target frame was taken, based on a state transition model **(Heinzmann:**

page 143, col 2, para 6: "probabilistic relocation of features based on template

correlations and a simple 2-D facial model");

applies the initial projected coordinates, and the first parameter and the

second parameter included in the predicted values of the state variables, to the model

coordinate arithmetic expression to calculate estimates of the model coordinates at the

time of photography **(Heinzmann: Fig. 1 and 3: Note that every frame corresponds**

to a time a photography);

applies the third parameter in the predicted values of the state variables

and the estimates of the model coordinates to the motion arithmetic expression to

calculate estimates of coordinates of the predetermined feature point at the time of

photography **(Heinzmann: page 146, col 1, para 1-2: third parameter can be**

interpreted to be confidence Figs. 1 and 3. See arguments made above for

parameters.);

applies the estimates of the coordinates of the predetermined feature point

to an observation function based on an observation model of the monocular camera to

calculate estimates of an observation vector of the predetermined feature point

(Heinzmann: page 146, col 1, para 1-2. Figs. 1 and 3);

makes the observation vector extracting means extract the projected

coordinates of the predetermined feature point from the processing target frame, as the

observation vector **(Heinzmann: page 145, col 1, para 3: "gaze vector"; Figs. 1 and**

3; page 146, col 1, para 2: "gaze vector"); and

filters the predicted values of the state variables by use of the extracted

observation vector and the estimates of the observation vector to calculate estimates of

the state variables at the time of photography **(Heinzmann: Fig. 1: "Kalman filtering".**

Note that every frame corresponds to a time of photography. As stated above, the state variables include the parameters. A coordinate is an observation vector originating from the origin in the corresponding coordinate space; page 145, col 1, para 3: "gaze vector"; Figs. 1 and 3; page 146, col 1, para 2: "gaze vector... Intersecting G, with a world mode1 yields the gaze point").

As per claim 2, Heinzmann teaches the image processing apparatus according to Claim 1, wherein the first parameter is a static parameter to converge at a specific value, and wherein the second parameter is a dynamic parameter to vary with the motion of the portion including the predetermined feature point **(Heinzmann: See arguments made for rejection claim 1: The static parameter can be interpreted to be the length (or depth) of the gaze vector that converges to a specific gaze point (page 146, col 1, para 2).The second dynamic value is the angle or orientation that varies over time along with the motion).**

As per claim 3, Heinzmann teaches the image processing apparatus according to Claim 2, wherein the static parameter is a depth from the image plane to the predetermined feature point **(Heinzmann: See arguments made for rejection claim 1, 2: The depth of the feature from the image plane is considered as a parameter.).**

As per claim 4, Heinzmann teaches the image processing apparatus according to Claim 2, wherein the dynamic parameter is a rotation parameter for specifying a

rotation motion of the portion including the predetermined feature point **(Heinzmann: See arguments made for rejection claim 1, 2: The rotation is considered as a parameter)**.

As per claim 5, Heinzmann teaches the image processing apparatus according to Claim 4, wherein the rotation parameter is angles made by a vector from an origin to the predetermined feature point, relative to two coordinate axes in a coordinate system whose origin is at a center of the portion including the predetermined feature point **(Heinzmann: See arguments made for rejection claim 1: page 146, col 1: "eye orientation… alpha_x, alpha_y… origin is located between the eyes")**.

As per claim 6, Heinzmann teaches the image processing apparatus according to Claim 1, wherein the first parameter is a rigid parameter, and wherein the second parameter is a non-rigid parameter **(Heinzmann: See arguments made for rejection claim 1, 2: The depth is the rigid parameter, and the angle/orientation is the non-rigid-parameter. Also, affine and perspective transformations are non-rigid transformation, but the depth would not be affected by the transformations)**.

As per claim 7, Heinzmann teaches the image processing apparatus according to Claim 6, wherein the rigid parameter is a depth from the image plane to the model coordinates **(Heinzmann: See arguments made for rejection claim 1, 6.)**.

As per claim 8, Heinzmann teaches the image processing apparatus according

to Claim 6, wherein the non-rigid parameter is a change amount about a position

change of the predetermined feature point due to the motion of the portion including the

predetermined feature point **(Heinzmann: See arguments made for rejection claim 1,**

5.).

As per claim 9, Heinzmann teaches the image processing apparatus according

to Claim 1, wherein the motion model is based on rotation and translation

motions of the 3D object, and wherein the third parameter is a translation parameter for

specifying a translation amount of the 3D object and a rotation parameter for specifying

a rotation amount of the 3D object **(Heinzmann: See arguments made for rejection**

claim 1, 2, and 5: Fig. 4: "Disp X... Disp Y": translation; Fig. 1: "template tracking"

Template tracking or matching accounts for in-plane translations. Fig. 3: "camera

coordinates... angles"; Fig. 1).

As per claim 23, Heinzmann teaches the image processing apparatus according

to Claim 1, wherein a 3D structure of a center of a pupil on a facial picture is

defined by a static parameter and a dynamic parameter, and wherein the a gaze is

determined by estimating the static parameter and the dynamic parameter

(Heinzmann: See arguments made for rejection claim 1, 2, 5, 9).

As per claim 24, Heinzmann teaches the image processing apparatus according

to Claim 23, wherein the static parameter is a depth of the pupil in a camera coordinate

system **(Heinzmann: See arguments made for rejection claim 1, 2, 5, 9)**.

As per claim 25, Heinzmann teaches the image processing apparatus according

to Claim 23, wherein the dynamic parameter is a rotation parameter of an eyeball

(Heinzmann: See arguments made for rejection claim 1, 2, 5, 9).

As per claim 26, Heinzmann teaches the image processing apparatus according

to Claim 25, wherein the rotation parameter of the eyeball has two degrees of freedom

to permit rotations with respect to two coordinate axes in an eyeball coordinate system

(Heinzmann: See arguments made for rejection claim 1, 2, 5, 9: alpha_x, alpha_y).

As per claim 27, Heinzmann teaches the image processing apparatus according

to Claim 1, wherein a 3D structure of the 3D object on the a picture is defined by a

rigid parameter and a non-rigid parameter and wherein the motion of the 3D object is

determined by estimating the rigid parameter and the non-rigid parameter **(Heinzmann:

See arguments made for rejection claim 1, 2, 5, 6, 9)**.

As per claim 28, Heinzmann teaches the image processing apparatus according

to Claim 27, wherein the rigid parameter is a depth of a feature point of the 3D object in

a model coordinate system **(Heinzmann: See arguments made for rejection claim 1, 2, 5, 6, 9)**.

As per claim 29, Heinzmann teaches the image processing apparatus according to Claim 27, wherein the non-rigid parameter is a change amount of a feature point of the 3D object in a model coordinate system **(Heinzmann: See arguments made for rejection claim 1, 2, 5, 6, 9)**.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over J. Heinzmann and A. Zelinsky, "3-D facial pose and gaze point estimation using a robust real-time tracking paradigm," IEEE Int. Workshop on Automatic Face and Gesture Recognition, pp142-147, 1998) (Heinzmann) as applied to claim 1 above, and further in view of Park, K. R., et al., "Gaze position detection by computing the three dimensional facial positions and motions," Pattern Recognition, Vol. 35, No. 11, Nov. 2002, pp. 2559-2569 (Park).

As per claim 10, Heinzmann teaches the image processing apparatus according to Claim 1, wherein the motion estimating means applies Kalman filtering as said filtering **(Heinzmann: See arguments made for rejecting claim 1)**. Heinzmann does not teach extended Kalman filtering.

Park teaches extended Kalman filtering **(Park: page 2564, col 1, para 4: "extended Kalman")**.

Thus, it would have been obvious for one of ordinary skill in the art at the time the invention was made to implement the teachings of Park into Heinzmann since Heinzmann suggests a system for determining face and gaze positions using Kalman filtering in general and Park suggests the beneficial use of a system for determining face and gaze positions using extended Kalman filtering as to in the analogous art of image processing. It would have been obvious for one of ordinary skill in the art at the time the invention was made to implement the teachings of Park into Heinzmann since it is well known that the extended Kalman filter is applicable to nonlinear problems whereas the Kalman filter is not. Therefore, one can apply the extended Kalman filter in order to obtain a more robust system. Furthermore, one of ordinary skill in the art at the time the invention was made could have combined the elements as claimed by known methods and, in combination, each component functions the same as it does separately. One of ordinary skill in the art at the time the invention was made would have recognized that the results of the combination would be predictable.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Atiba Fitzpatrick whose telephone number is (571) 270-5255. The examiner can normally be reached on M-F 10:00am-6pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Samir Ahmed can be reached on (571)272-7413. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Atiba Fitzpatrick

/A. O. F./

Examiner, Art Unit 2624

/Samir A. Ahmed/

Supervisory Patent Examiner, Art Unit 2624